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Industry 4.0 – Challenges and Consequences for the Economical and Social Growth in Bulgaria

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HANDS-ON EXPERIENCE

Implementation of Industry 4.0 at SMEs: Minimizing Risks and Identifying Opportunities

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Industry 4.0: What is behind it?

Total Digitization and Networking

North America Europe Asia Latin America

North America Europe Asia Latin America Africa

25 billion devices and 5 billion people by 2020.

Source: *Gartner,* ***Pictures:*** *Festo / blog.kaspersky.com*

Buzzwords

Digitization and networking make borders disappear.

Source: *own representation*

From Digitization to Digitalization

Hypermedia
NETWORKING OF DOCUMENTS

1985

1994

1995

1994

1995

World Wide Web

Web 0.0

Multimedia
NETWORKING OF MEDIA

1998

1999

Java, UML, XML

Web 1.0

Social media 1st
NETWORKING OF PEOPLE

2004

2005

2006

Web Services

Web 2.0

1990 1995 2000 2005 **Time**

Source: *adapted from R. Anderl, DiK and ITK Engineering AG*

From Digitalization to Industry 4.0

Social media 2nd
NETWORKING OF BUSINESSES

App Technologies

Web 3.0

Cyber-physical media
NETWORKING OF SYSTEMS

Internet of Things

Web A.B

Human-machine media
NETWORKING OF BRAINS AND COMPUTERS

Internet of Senses

Web X.Y

2010 — 2015 — 2020 — 2025 … **Time**

Source: *own representation,* ***Pictures*** *left: Etailment, right: Youtube*

Industry 4.0 - What Everyone Must Know

Dream team:

- Prof. Kagermann, acatech
- Prof. Wahlster, DFKI
- Prof. Lukas, BMBF

at the Hannover Fair in 2011

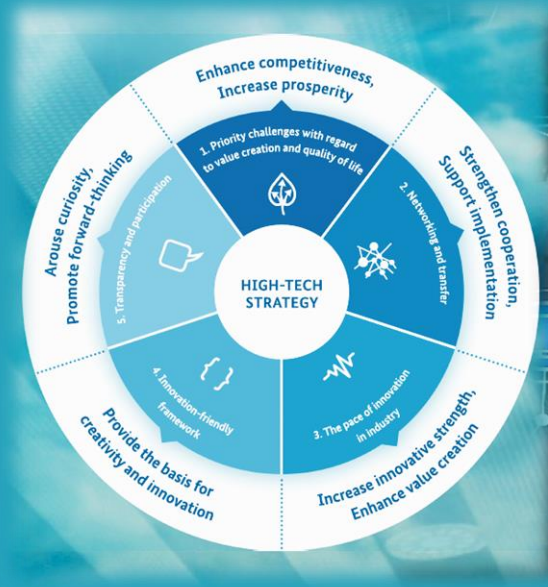
Design principles:

- System interoperability I Internet of thigs
- Information transparency I Virtual twins
- Technical assistance I Artificial intelligence
- Decentralized decisions I Cyber-physical systems

Computers and automation come together in a new way.

Source: *acatech*

Beyond Industry 4.0 - New High-Tech Strategy



1

- Digital economy and society
- Sustainable economy and energy
- Innovative working environment
- Healthy living
- Intelligent mobility
- Civil security

2

New measures to strategically expand universities' options for cooperation with industry and society.

3

Expand the group of companies that participate in programmes for innovative small and medium-sized enterprises (SMEs).

4

Plan new initiatives for enough skilled personnel – including initiatives in STEM/MINT subject.

5

Develop new participation formats including formats for citizens' dialogues and public participation in research.

Innovation includes society as a central player.

Source: *German Federal Ministry of Education and Research, August 2014*

Causes and Consequences

Degree of Innovation

Industry 1.0
Mass production

Industry 2.0
Mass distribution

Industry 3.0
World economy

Industry 4.0
Smart society!

Mechanization
hydro- and steam power

Electrification
electrical power and vehicle mobility

Automation
computer and information technology

Cyberization
smart devices and humans, real time interconnections

End of the 18th century | Beginning of the 20th century | Beginning of the 70's | Today | **Time**

Source: *own representation*

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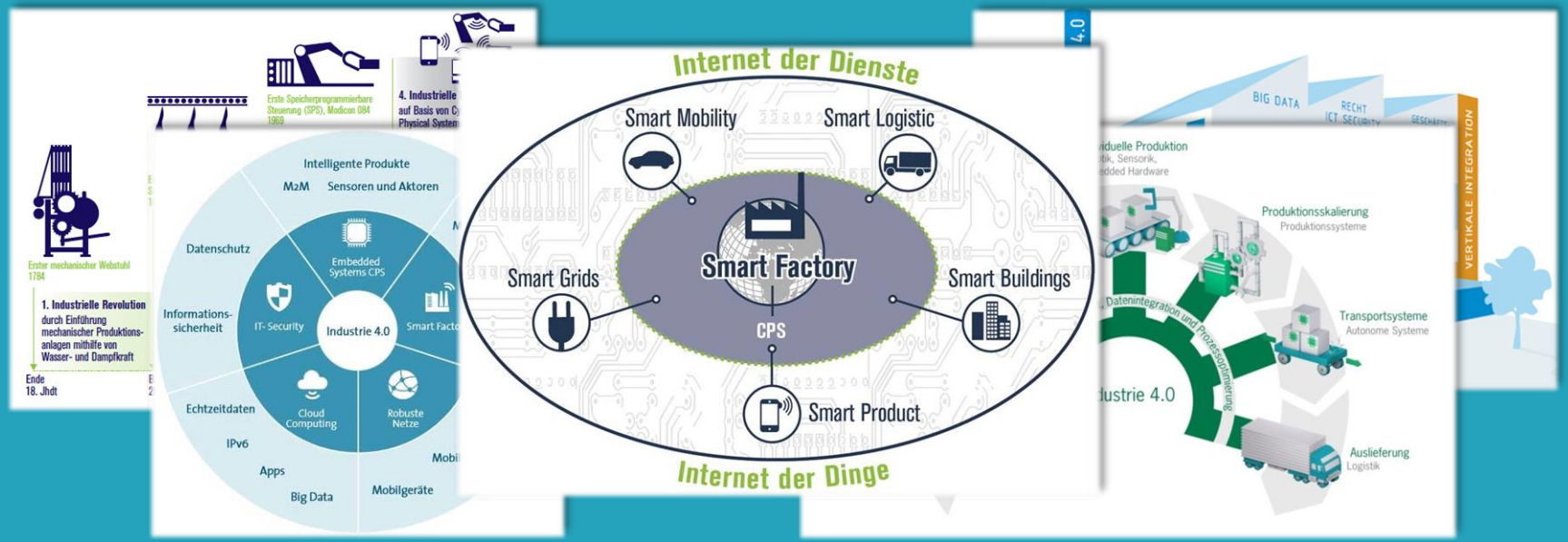
Industry 4.0 at SMEs: Motivation

The „German Mittelstand“ is a Trademark

German thoroughness is no longer enough.

Source: *BMWi/Eriksson, 10.04.2017,* ***Pictures:*** *Volksbank Münster*

The Status Quo Industry 4.0



The majority of companies are at the beginning.

Pictures: *DFKI, IAO/bitcom, VDI, FZI, acatech*

Example: VR Application for Industry 4.0

"Virtual Reality where anyone can experience anything."

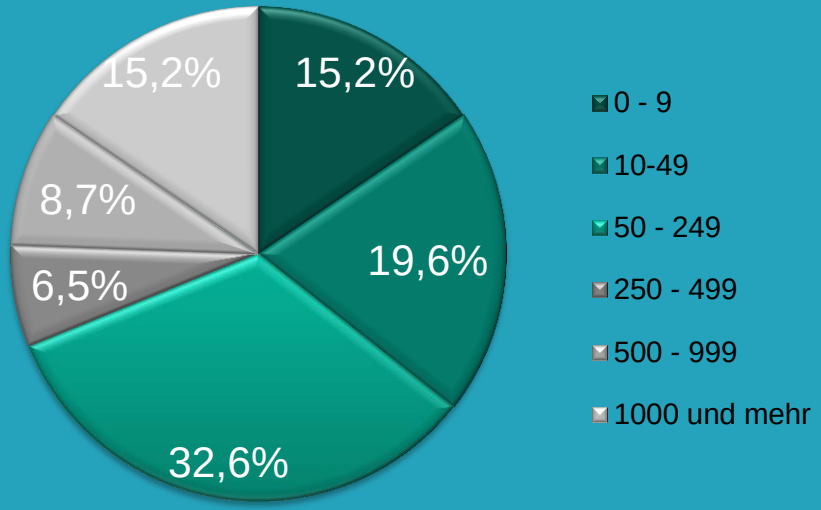
Pictures: *sueddeutsche.de, VR SYNC Kino von evrbit HEADTRIP, Facebook, Mark Zuckerberg I IndustryWeek, 25 February 2016*

Example: VR Application for Industry 4.0

Company profile

- 46 Participants
- 50 % deal with VR
- above-average Interest
- Industrial sectors:
  - Mechanical Engineering and Plants (26%)
  - Information Technology (17%)
  - Civil Engineering & Architecture (12%)
  - Services (12%)
  - Automotive (7%)
  - Electronics (7%)
  - others (19%)

Number of employees



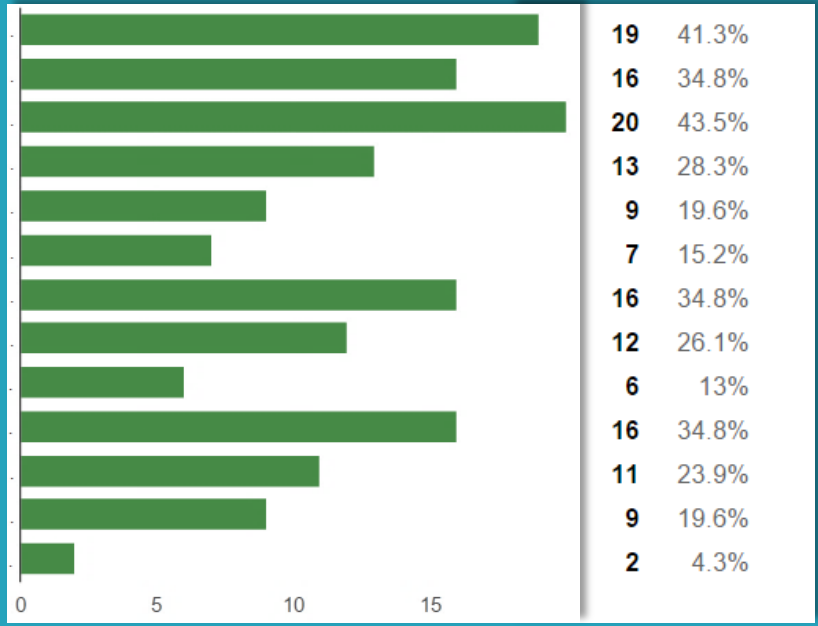
Source: *Analyse der Wirtschaftlichkeit der Virtual-Reality-Technologie im Kontext von Industrie 4.0, Masterarbeit J. Dücker, KIT, 2015*

Example: VR Application for Industry 4.0

Identified hurdles

- Insufficient knowledge about the topic
- Enormous time effort
- High investment risk
- Low acceptance among employees
- Low acceptance also among customers and suppliers
- No experiences in integration into business processes
- Lack of human resources and capacity
- Lack of appropriate software solutions
- Lack of practical experiences
- Missing professional skills and qualification
- Missing data preparation and analysis
- No meaningful applications
- others

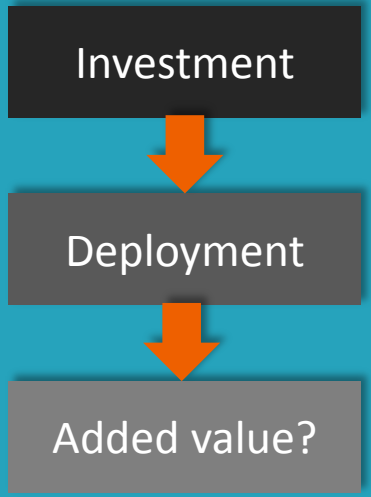
Analysis of the results



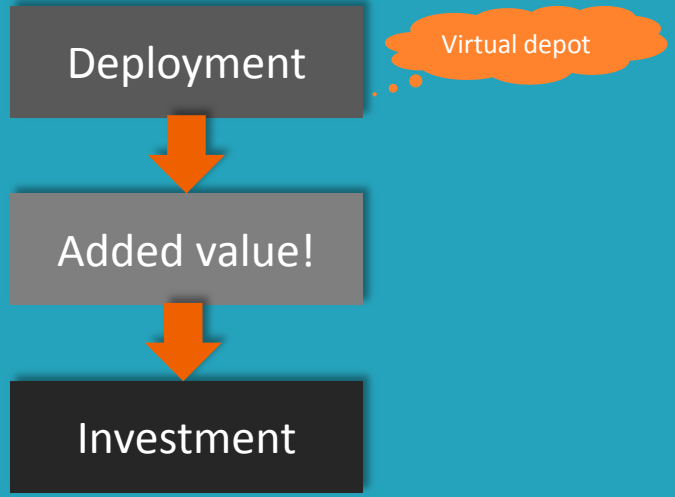
Source: *Analyse der Wirtschaftlichkeit der Virtual-Reality-Technologie im Kontext von Industrie 4.0, Masterarbeit J. Dücker, KIT, 2015*

Example: VR Application for Industry 4.0

Traditional implementation



Required implementation



„A virtual depot - what to practice“ is necessary.

Source: *own representation*

HANDS-ON EXPERIENCE

Why, What, Who?

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Why, What, Who?

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Three reasons to start right now

REASON #1

Internet Platforms

Internet Platform as a Marketplace

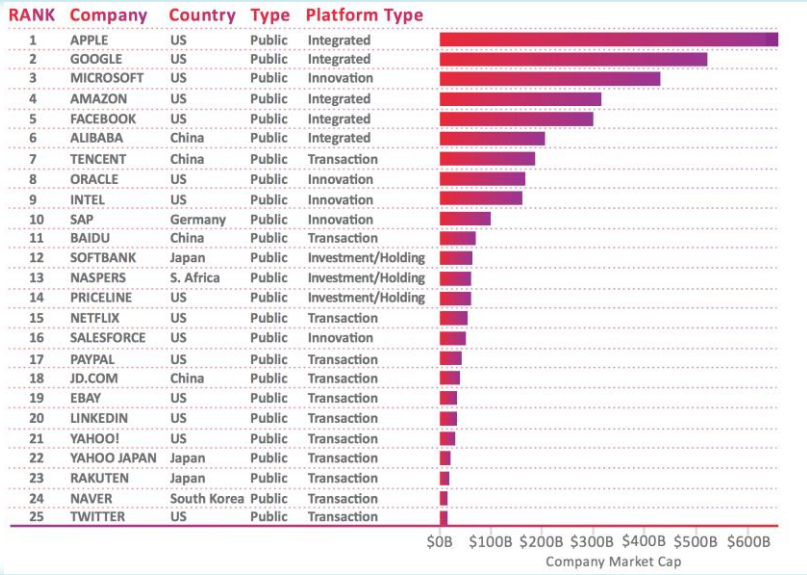
The more users are on a single platform, the more data can be collected, networked, and used to tailor customer relationships - adding relevance to new business models. At the same time, sales can be generated with each individual service.

ONE Platform for B2B, B2C, C2C.

Source: *adapted by Holger Schmidt, Digitale Plattformen – das zentrale Geschäftsmodell für Unternehmen der digitalen Wirtschaft*

Market Capitalization of Internet Platforms

RANK	Company	Country	Type	Platform Type
1	APPLE	US	Public	Integrated
2	GOOGLE	US	Public	Integrated
3	MICROSOFT	US	Public	Innovation
4	AMAZON	US	Public	Integrated
5	FACEBOOK	US	Public	Integrated
6	ALIBABA	China	Public	Integrated
7	TENCENT	China	Public	Transaction
8	ORACLE	US	Public	Innovation
9	INTEL	US	Public	Innovation
10	SAP	Germany	Public	Innovation
11	BAIDU	China	Public	Transaction
12	SOFTBANK	Japan	Public	Investment/Holding
13	NASPERS	S. Africa	Public	Investment/Holding
14	PRICELINE	US	Public	Investment/Holding
15	NETFLIX	US	Public	Transaction
16	SALESFORCE	US	Public	Innovation
17	PAYPAL	US	Public	Transaction
18	JD.COM	China	Public	Transaction
19	EBAY	US	Public	Transaction
20	LINKEDIN	US	Public	Transaction
21	YAHOO!	US	Public	Transaction
22	YAHOO JAPAN	Japan	Public	Transaction
23	RAKUTEN	Japan	Public	Transaction
24	NAVER	South Korea	Public	Transaction
25	TWITTER	US	Public	Transaction



Customer-oriented added value anytime and everywhere.

Source: *Global Platform Survey, 2016*

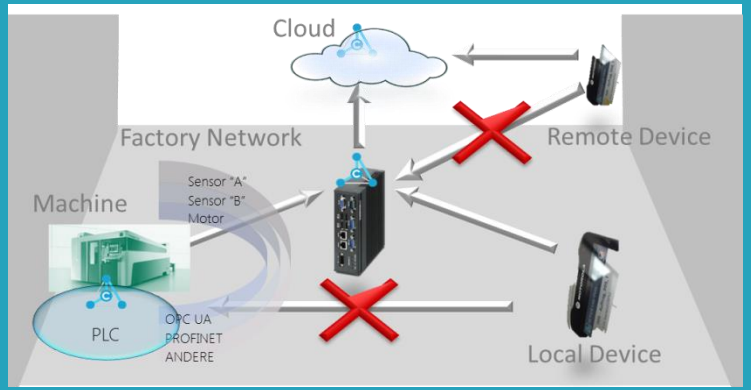
Example: Industrial Internet Platform

ONE Platform, MANY Partners and Solutions.

Figure: *Trumpf GmbH, Andre Mahl, FA Service*

Example: Industrial Internet Platform

- Machine access remote and mobile
- User interface for feedback and control
- No unsecure incoming connections
- Compliant with enterprise IT policies



Condition monitoring as a cloud solution.

Video and Figure: *Trumpf GmbH, Andre Mahl, FA Service*

REASON #2

Digital Business Models

Main Idea

„Code map“ – Software Map of business logic that becomes autonomous, networked, and real-time capable through (predominantly) internet-based algorithms.

1. „Divide-and-Conquer “ – Problem partitioning in executable specific applications (Apps).
2. „Crowd-and-Use“ – Purpose-oriented cooperation of productive people to achieve mutually beneficial goals.

Quelle: *nach Christian Hoffmeister, digitalbusinessmodels.wordpress.com/2013/08/25/*

Examples: Digital Business Models

Taxi services **Private accommodation** **Print media**

Algorithms "on-line", independent and adaptive.

Source: *own representation*

Example: Digital Business Models

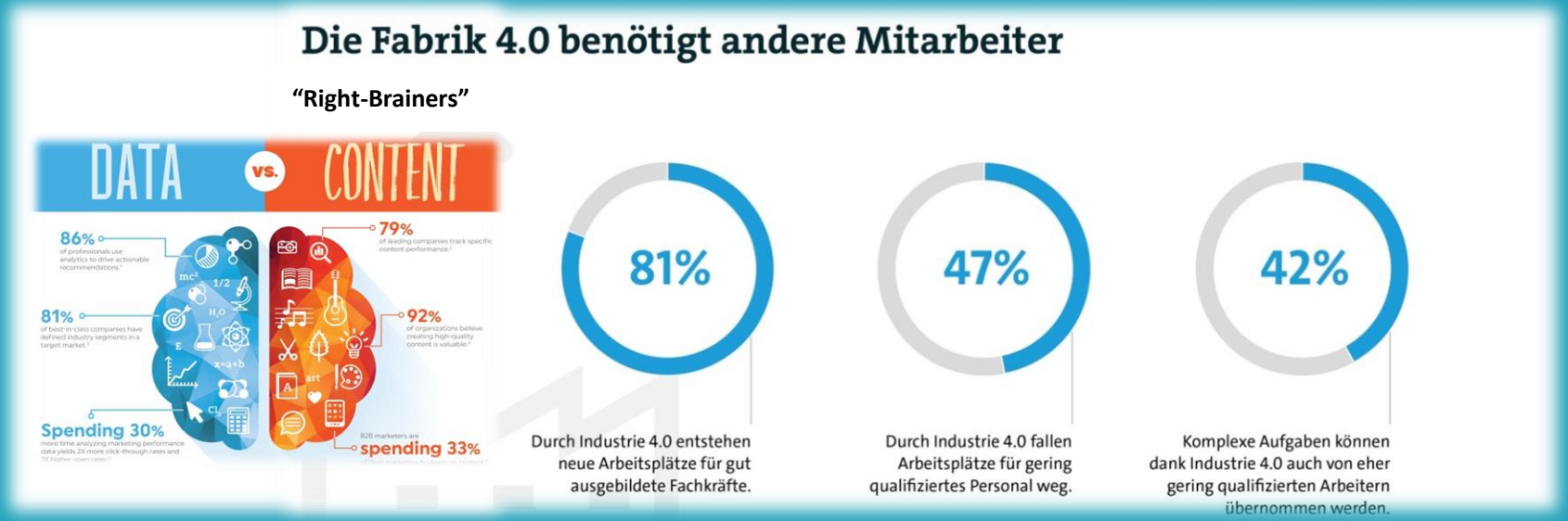
Predictive maintenance to improve services for customers.

Picture: *SAP AG, Marc Leu, SAP Japan*

REASON #3

Qualification for New Jobs

„Resourceful Humans“ vs. „Human Resources“



„Nine-to-five“ work model of serial production is over!

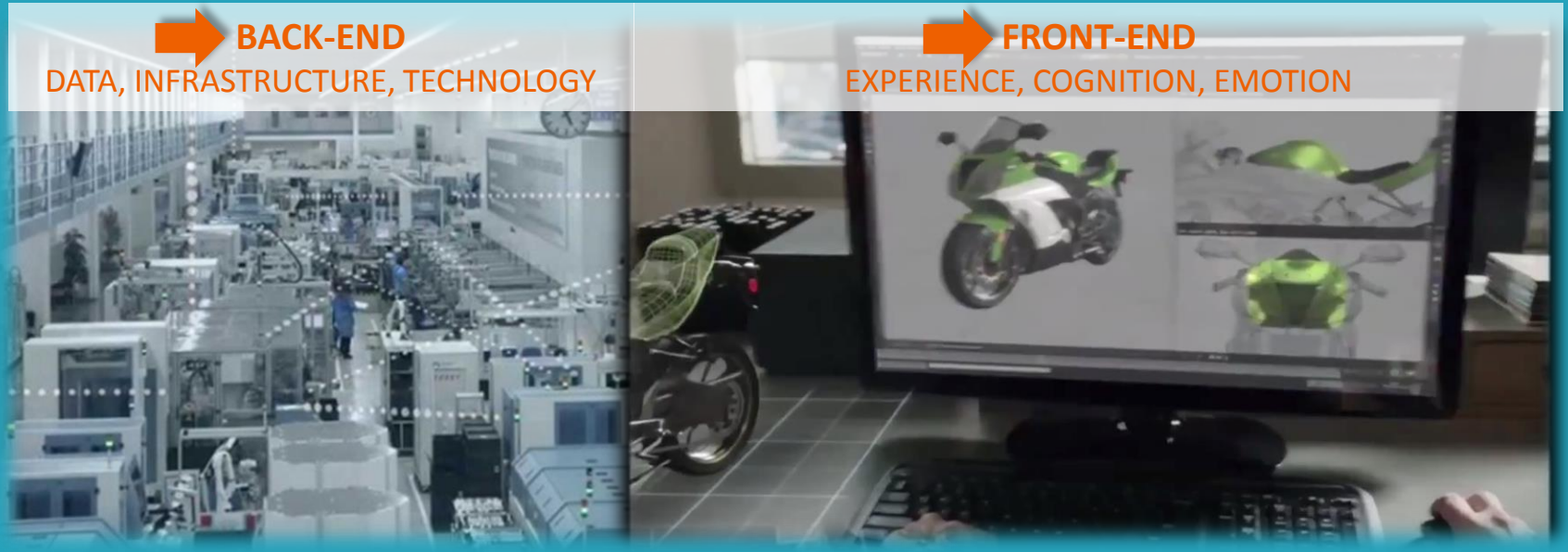
Pictures: *left Content_Roberts Communications, right: Bitcom Reseach*

Make machines intelligent?

Networked data, things, services.

***Picture** left: Forschungsunion*

Make People intelligent!



Technical and social worlds merge.

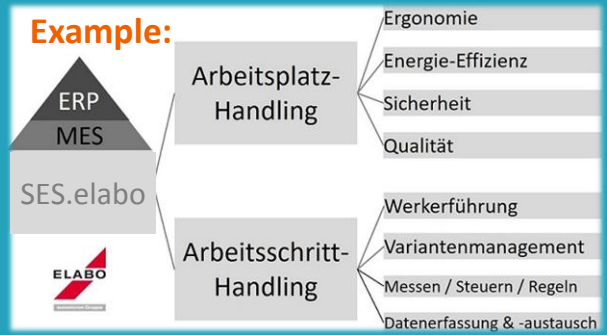
Source: *own representation,* ***Picture:*** *Forschungsunion,* ***Video:*** *Microsoft Hololens*

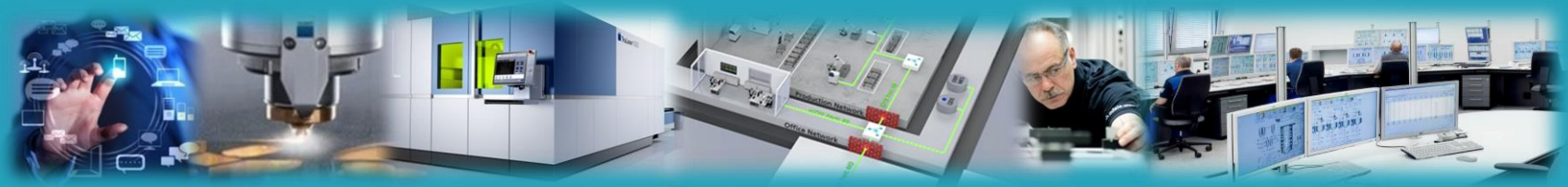
HANDS-ON EXPERIENCE

Why, What, Who?

„Sandbox“ Objectives

- Tools and Methods „All-in-One“
- Workplaces and Workflows are united
- Humans and Machines cooperate
- New Skills to compete in Today's Market
- Learning and Training on the job





Leadership at the origin of digital value creation.

Pictures: *Trumpf GmbH, Elabo GmbH*

„Sandbox“ Principle

- Think, try out, create “All-in-One"
- Put real problems "in the sandbox"
- Applying emerging technologies playfully
- Try solutions in runtime environment
- Transform knowledge into action and skills

“Let me try it, and I'll be able to do it.“

Pictures: *sik-holz.de, sandkasten.de, LESC (KIT), Arku GmbH, Elabo GmbH* ***Citation:*** *adapted by Confucius (551 – 479 before Christ)*

„Sandbox“ Technologies

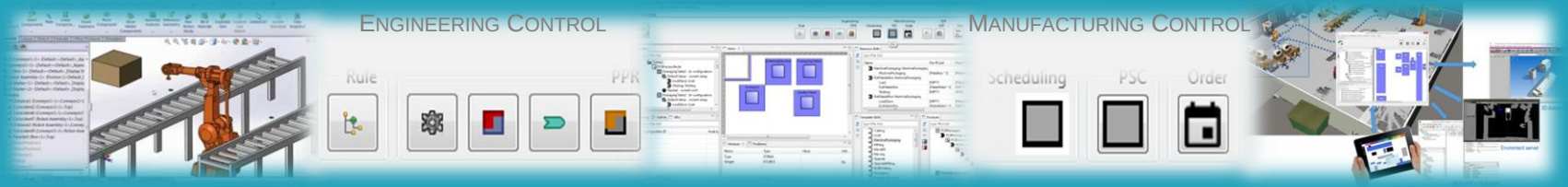
- High-speed internet infrastructure
- Low-priced, user-friendly and mobile devices
- Fast 3D graphics hardware
- Web-based software applications
- 3D input, output and printing technologies

New generation „German Engineering“ as a trademark.

Pictures: *Industry 4.0 Collaboration Lab (KIT)*

„Sandbox“ Solutions

- Open „plug & work“ workplaces
- Customer-oriented renting or sharing
- Data preparation, analysis and use
- Condition monitoring and predictive maintenance
- Increasing visibility and competitiveness



Increase customer involvement in business processes.

Pictures: *Industry 4.0 Collaboration Lab (KIT)*

„Sandbox“ for Learning and Training

- Training during and after development
- Shortening the time to real use
- Improved user-friendliness
- Early generation of technical documentation
- Digital education and qualification

Learn it right the first time!

Pictures: *Industry 4.0 Collaboration Lab (KIT)*

„Sandbox“ for Virtual Commissioning

- Validation of machines and entire production lines
- Data homogenization and quality check
- Virtual testing of machine code
- Reduction of complexity, interfaces and production errors
- Increasing transparency for end customers

Do it right the first time!

Pictures: *Industry 4.0 Collaboration Lab (KIT)*

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Why, What, Who?

Industry 4.0 Collaboration Lab at KIT


Opening
24. September 2014

Hannover Fair
14. April 2015


Price
19. Februar 2016


LEXER Corner
17. Mai 2017


Innovation Forum Hangzhou
17. Mai 2017

„Sandbox“ for experiments in runtime environment.

Pictures: *Industry 4.0 Collaboration Lab (KIT)*

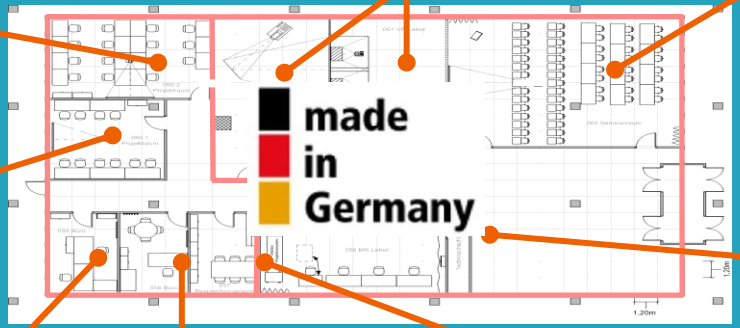
„Sandbox“ Infrastructure

Content Creation Lab
Entwicklung und Training mit CAx/PLM

Virtual Environments Lab
Mehrseitiges CAVE VR system

Communication Lab
Co-Working-and-Sharing-Raum

Value Creation Lab
Demonstration und praktische Anwendung



Mixed Reality Lab
Fahrsimulation, HTC, HoloLens, haptische Interaktion

Experience Lab
Digitale Lösungen für den Shopfloor

International Cooperation Lab
LEXER Inc. Japan, FDIBA-TU Sofia, Bulgarien

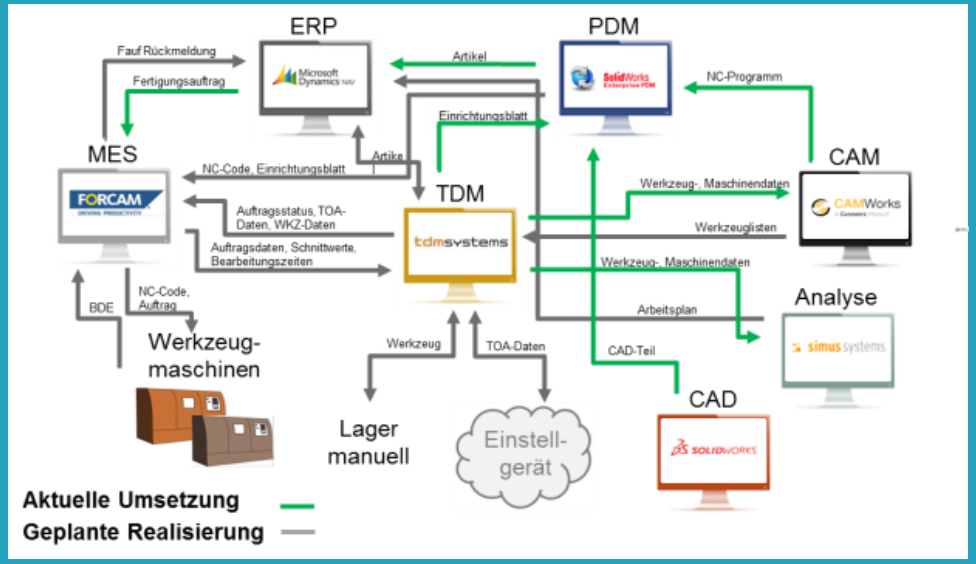
Tea Lab
Kreativ-Think-Tank

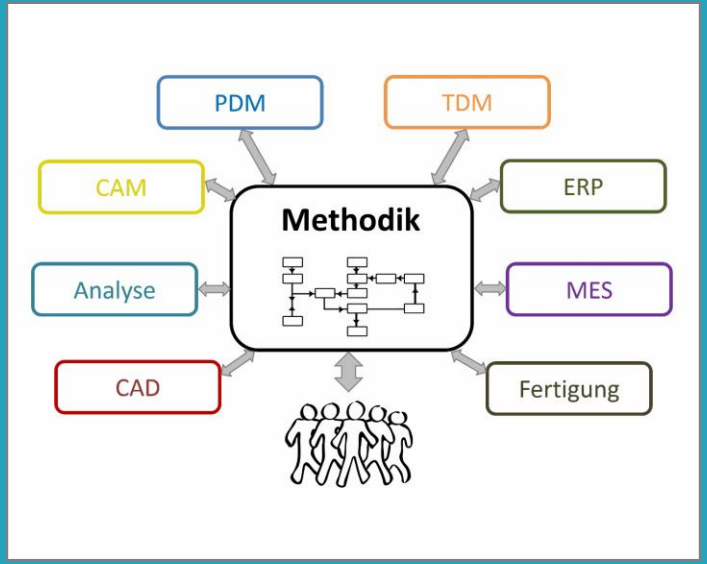
Pictures: *Industry 4.0 Collaboration Lab (KIT)*

THE SANDBOX IN ACTION

Examples ready to use in Bulgaria

Real-time tool management





Flexible cloud-based IT systems solution.

***Figure** and **Video:** Industry 4.0 Collaboration Lab (KIT)*

Virtual Twin

Real-time product and process simulation.

Videos: *Industry 4.0 Collaboration Lab (KIT), Gabler GmbH*

Customer-oriented Planning

Customer involvement in the planning process directly.

Video: *InReal*

Real Estate Economy

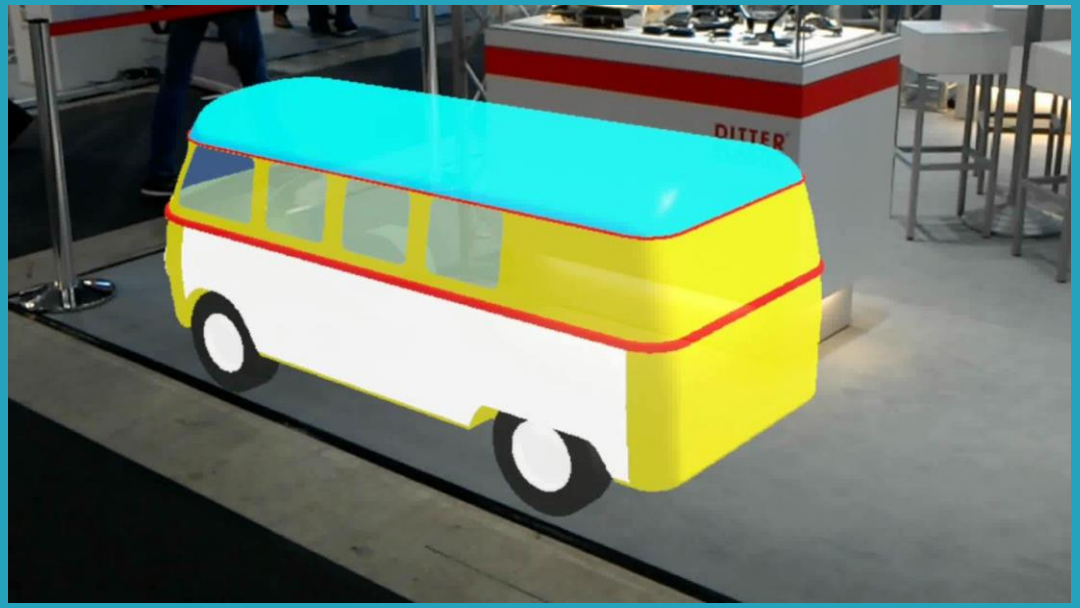
3D-Scan

VR-Model

Digitization and marketing of rental apartments.

Video: *IMI/KIT*

Fair Presence



Individual apps, attention directly to your product.

Video: *Arnold IT-Systems & HoloLens*

Killer Instinct is needed

Jivka Ovtcharova

“Sandbox” solutions for real-time applications

Join us!

Karlsruhe Institute of Technology (KIT)
Institute for Information Management in Engineering (IMI)


Killer Instinct is needed
Join us!